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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/602,194      | 06/23/2003  | Yoshi Ono            | SLA 0669            | 9996             |

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EXAMINER

NGUYEN, KHIEM D

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
|----------|--------------|

2823

DATE MAILED: 01/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

✓ ~~10~~ page 10 EX

|                              |                                      |                                   |  |
|------------------------------|--------------------------------------|-----------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/602,194 | <b>Applicant(s)</b><br>ONO, YOSHI |  |
|                              | <b>Examiner</b><br>Khiem D. Nguyen   | <b>Art Unit</b><br>2823           |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 27 October 2005.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-5,7-11 and 13-21 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1-5,7-11 and 13-21 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 23 June 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

**DETAILED ACTION*****Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

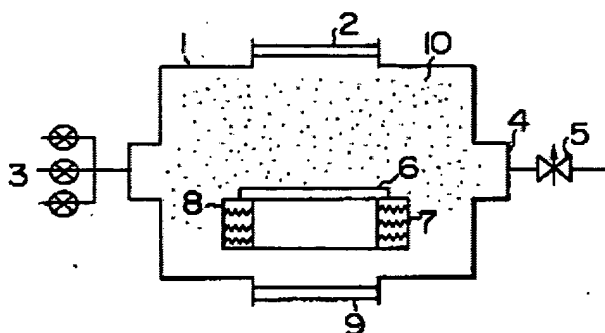
Claims 1-5, 7-11 and 13-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Azuma et al. (U.S. Patent 4,495,218).

In re claim 1, Azuma discloses a method of low-temperature nitridation of a silicon substrate comprising:

placing a silicon wafer 6 in a vacuum chamber 1 on a heated chuck 7;

maintaining the silicon wafer 6 at a temperature of between about 20 to 400 °C

(col. 2, lines 30-60 and FIG. 1);



introducing a nitrogen-containing gas into the vacuum chamber 1, wherein the nitrogen-containing gas is taken from the group of gases consisting of  $\text{NH}_3$  (col. 3, lines 11-13);

dissociating the nitrogen-containing gas into nitrogen with a xenon excimer lamp, and flowing the nitrogen over the silicon wafer 6 (col. 2, lines 40-45). Note that the xenon excimer lamp as taught by Azuma inherently operating at a wavelength of 172 nm to flow the nitrogen over the silicon wafer 6; and

growing a silicon nitride layer on at least a portion of the silicon wafer 6, wherein the silicon nitride layer is formed from silicon in the silicon wafer and nitrogen from the dissociated nitrogen-containing gas (col. 3, lines 11-39 and col. 4, lines 24-33).

Azuma teaches that the silicon nitride layer was formed at a film forming rate of about 150 Angstroms/min but does not explicitly disclose that the silicon nitride layer so formed has a thickness of less than 5 nm as recited in the independent claim 1.

However, there is no evidence indicating the thickness of the silicon nitride layer is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claim 2, Azuma discloses that the method of claim 1 which further includes maintaining the vacuum chamber at a pressure of between about 0.1 to 100 Torr (col. 2, lines 52-56).

In re claim 3, Azuma discloses introducing the nitrogen containing gas in the vacuum chamber includes providing a gas flow rate of 20-30 Angstroms/min (col. 3, lines 17-30).

In re claim 4, Azuma does not explicitly teach maintaining the wafer in the vacuum chamber in contact with nitrogen for between about thirty seconds and three hours.

However, there is no evidence indicating the time duration that the wafer in contact with nitrogen is critical and it has been held that it is not inventive to discover the optimum or workable time duration of a result-effective variable within given prior art conditions by routine experimentation.

In re claim 5, Azuma does not explicitly teach forming a silicon nitride layer on a silicon wafer in a time period of between about thirty seconds to three hours.

However, there is no evidence indicating the time duration that the forming a silicon nitride layer on a silicon wafer is critical and it has been held that it is not inventive to discover the optimum or workable time duration of a result-effective variable within given prior art conditions by routine experimentation.

In re claim 7, Azuma discloses that the forming includes providing a positively charged interface across the nitride layer (col. 4, lines 6-21).

In re claim 8, Azuma discloses that placing includes placing a silicon wafer 6 having a layer of silicon oxide on the upper surface thereof in a vacuum chamber (FIG. 1 and related text).

growing a silicon nitride layer on at least a portion of the silicon wafer 6, wherein the silicon nitride layer is formed from silicon in the silicon wafer and nitrogen from the dissociated nitrogen-containing gas (col. 3, lines 11-39 and col. 4, lines 24-33).

Azuma teaches that the silicon nitride layer was formed at a film forming rate of about 150 Angstroms/min but does not explicitly disclose that the silicon nitride layer so formed has a thickness of less than 5 nm as recited in the independent claim 9.

However, there is no evidence indicating the thickness of the silicon nitride layer is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claim 10, Azuma does not explicitly teach forming a silicon nitride layer on a silicon wafer in a time period of between about thirty seconds to three hours.

However, there is no evidence indicating the time duration that the forming a silicon nitride layer on a silicon wafer is critical and it has been held that it is not inventive to discover the optimum or workable time duration of a result-effective variable within given prior art conditions by routine experimentation.

In re claim 11, Azuma does not explicitly teach maintaining the wafer in the vacuum chamber in contact with nitrogen for between about thirty seconds and three hours.

However, there is no evidence indicating the time duration that the wafer in contact with nitrogen is critical and it has been held that it is not inventive to discover the optimum or workable time duration of a result-effective variable within given prior art conditions by routine experimentation.

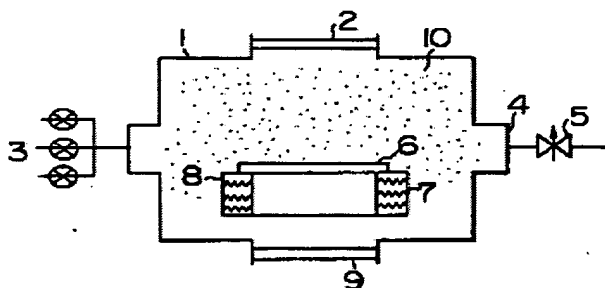
In re claim 13, Azuma discloses introducing the nitrogen containing gas in the vacuum chamber includes providing a gas flow rate of 20-30 Angstroms/min (col. 3, lines 17-30).

In re claim 14, Azuma discloses that the forming includes providing a positively charged interface across the nitride layer (col. 4, lines 6-21).

In re claim 15, Azuma discloses that placing includes placing a silicon wafer 6 having a layer of silicon oxide on the upper surface thereof in a vacuum chamber (FIG. 1 and related text).

In re claim 16, Azuma discloses a method of low-temperature nitridation of a silicon substrate comprising:

placing a silicon wafer 6 in a vacuum chamber 1 on a heated chuck 7;



maintaining the silicon wafer 6 at a temperature of between about 20 to 400 °C (col. 2, lines 30-60 and FIG. 1);



providing a positively charged interface across the nitride layer (col. 4, lines 6-21)

introducing a nitrogen-containing gas into the vacuum chamber 1, wherein the nitrogen-containing gas is taken from the group of gases consisting of  $\text{NH}_3$  (col. 3, lines 11-13);

dissociating the nitrogen-containing gas into nitrogen with a xenon excimer lamp, and flowing the nitrogen over the silicon wafer 6 (col. 2, lines 40-45). Note that the xenon excimer lamp as taught by Azuma inherently operating at a wavelength of 172 nm to flow the nitrogen over the silicon wafer 6; and

growing a silicon nitride layer on at least a portion of the silicon wafer 6, wherein the silicon nitride layer is formed from silicon in the silicon wafer and nitrogen from the dissociated nitrogen-containing gas (col. 3, lines 11-39 and col. 4, lines 24-33).

Azuma teaches that the silicon nitride layer was formed at a film forming rate of about 150 Angstroms/min but does not explicitly disclose that the silicon nitride layer so formed has a thickness of less than 5 nm as recited in the independent claim 16.

However, there is no evidence indicating the thickness of the silicon nitride layer is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the

chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claim 17, Azuma discloses that the nitrogen-containing gas is taken from the group of gases consisting of  $\text{NH}_3$  (col. 3, lines 11-13).

In re claim 18, Azuma discloses that the method of claim 16 which further includes maintaining the vacuum chamber at a pressure of between about 0.1 to 100 Torr (col. 2, lines 52-56).

In re claim 19, Azuma does not explicitly teach forming a silicon nitride layer on a silicon wafer in a time period of between about thirty seconds to three hours.

However, there is no evidence indicating the time duration that the forming a silicon nitride layer on a silicon wafer is critical and it has been held that it is not inventive to discover the optimum or workable time duration of a result-effective variable within given prior art conditions by routine experimentation.

In re claim 20, Azuma does not explicitly teach maintaining the wafer in the vacuum chamber in contact with nitrogen for between about thirty seconds and three hours.

However, there is no evidence indicating the time duration that the wafer in contact with nitrogen is critical and it has been held that it is not inventive to discover the optimum or workable time duration of a result-effective variable within given prior art conditions by routine experimentation.

In re claim 21, Azuma discloses introducing the nitrogen containing gas in the vacuum chamber includes providing a gas flow rate of 20-30 Angstroms/min (col. 3, lines 17-30).

***Response to Applicant's Arguments and Amendment***

Applicant's arguments filed October 27<sup>th</sup>, 2005 have been fully considered but they are not persuasive.

Applicant contends that claims 1, 9, and 16, all of the independent claims, have been amended to clarify that the silicon nitride layer of the method of the invention is grown on the substrate, vs. deposited on a substrate as disclosed by Azuma et al. reference (U.S. Patent 4,495,218) herein known as Azuma.

In response to Applicant's contention that there is a difference between depositing a layer of material as disclosed by Azuma and growing a layer of material as recited in the Applicant's claimed invention, Examiner respectfully disagrees. According to the definition of the word "grow" obtaining from the Collegiate Dictionary (attachment herewith), to grow a layer of material, mean to increase in size by assimilation of material. Azuma discloses that the film-forming rate is at least 20 to 20 Angstroms per minute. Thus, Azuma does teach growing a silicon nitride layer to a predetermined thickness on a portion of the silicon wafer (col. 3, lines 17-30, Azuma).

For this reason, Examiner holds the rejection proper.

***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D. Nguyen whose telephone number is (571) 272-1865. The examiner can normally be reached on Monday-Friday (8:30 AM - 5:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

K.N.  
January 6, 2006



**W. DAVID COLEMAN**  
**PRIMARY EXAMINER**